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REMARKS

Entry of this amendment and reconsideration of this application, as amended, is respectfully requested.

It is not believed that the 35 U.S.C. §112, second paragraph applies to the presently amended claims.

Claims 1-10 were rejected under 35 U.S.C. §103(a) as allegedly obvious over JP 6-90824 ('824) and also over Nakagawa in view of Sakuma in view of JP 6-90824. Applicants respectfully traverse each of these rejections.

The accompanying circuit diagram and explanation are provided to aid the Examiner added to this invention.

According to the presently claimed invention, an n-type semiconductor is electrically connected to negative pole of a solar battery and to provide an effective photocatalytic action. Since the toothbrush is constantly charged while the teeth are brushed, e.g., in a fluorescently lighted lavatory or a bright place filled with sunlight, the photocatalytic action of the n-type semiconductor is not lowered with operating time, and the effect of this invention the generation efficiency of OH radical is enhanced and the pH is not lowered.

In the case of a primary battery, since voltage drop gradually occurs with the operating time, a voltage is lowered with the operating time and its effect is lowered before a user of the toothbrush notices. This is similar to a secondary battery which can be charged.

In addition, the solar battery is in a shape of a thin plate and can be sufficiently built in a part such as a holder of the toothbrush along its inner surface; it is not necessary to thicken the holder portion to accept conventional batteries. This reduces manufacturing costs.

Furthermore, the lifespan of a solar battery is typically more than 20 years, which is far longer than that of the primary battery and also longer than the secondary battery. Therefore, it is not necessary for the user of the toothbrush to change the battery frequently.

Additionally, the lifespan the solar battery is relatively long, so its manufacturing cost can be low. The secondary battery, which can be charged, requires a charger and power consumption to charge the secondary battery increasing costs compared to solar battery.

Leaks are not generated in the solar battery when it deteriorates, unlike the primary and secondary batteries. When a leak is generated, electrodes can be shorted out, and when a short is generated, heat generation, ignition, burst or the like could occur. Therefore, it is not preferable to use the primary or secondary battery for the toothbrush. In addition, with a primary battery, it is necessary to detach the battery when the toothbrush is not used for a time. A solar battery does not have the foregoing problem(s).

Because the n-type semiconductor is connected to the negative pole of the solar battery, there is an outstanding antiseptic effect with references to the attached drawings. Experimental conditions to test this effect were as follows:

Streptococcus mutans IFO 13955 is regarded as a cause of tooth decay. Normal saline of 4mL is put in a test tube and test bacteria are inoculated such to attain a concentration of from about 10,000 to 20,000/mL. A fluorescent light (6W and a distance of 10cm) is irradiated for 1 to 5 minutes at a room temperature using the solar battery. The viable cell count in the normal saline of 1mL was measured in a standard agar medium. The initial number of bacteria was 1.3×10^4 /mL.

Referring to the accompanying drawing. (A) designates an embodiment where the n-type semiconductor is connected to the negative pole of the solar battery (which corresponds to this

invention), (B) designates a case where the n-type semiconductor is connected to a positive pole of the solar battery, and (C) designates a blank in which neither the n-type semiconductor nor the solar battery is used.

In embodiment (A) especially, colony of Streptococcus mutans is rapidly reduced for a short time and an outstanding antibacterial effect is provided. Since teeth brushing is normally performed for short time in many cases, the toothbrush according to this invention has practical use not taught or suggested by the cited references.

In addition, as to the references, the invention described in JP 6-90824 was invented by one inventor of this invention and discloses an electric toothbrush incorporating a motor driven by a battery. However, according to JP6-90824, as shown in Fig. 5, a positive pole of a battery is connected to an n-type semiconductor and as can be seen from the accompanying drawing. The photocatalytic action of the n-type semiconductor was not sufficient as compared to the present invention.

In addition, according to the toothbrush disclosed in JP6-90824, a high power of the battery is consumed in driving a motor to rotate the brush and a large current flows. As a result, the photocatalytic action is not sufficiently provided by the n-type semiconductor because power drop in the n-type semiconductor is large. Furthermore, since voltage drop gradually occurs while the toothbrush is used in a primary battery used in JP6-90824, the photocatalytic action is not sufficiently provided.

Moreover, there is no description of connection between the negative pole of the battery and the n-type semiconductor and no suggestion thereof in JP6-90824 because such effect was not known at that time.

Besides, as described in US 4,526,570, any knowledge about the polarity was not provided at the time of the application and therefore, there is no description of the connection between the negative pole of the battery and the n-type semiconductor and also no suggestion to do so.

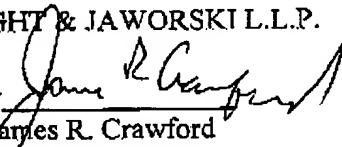
There is hint or suggestion of the present invention in any of the other cited references either.

In view of the foregoing, allowance is respectfully requested.

The Commissioner is hereby authorized to charge any deficiency in the fees filed, asserted to be filed or which should have been filed herewith (or with any paper hereafter filed in this application by this firm) to our Deposit Account No. 50-0624, under Order No. NY-UNIUS-203-US.

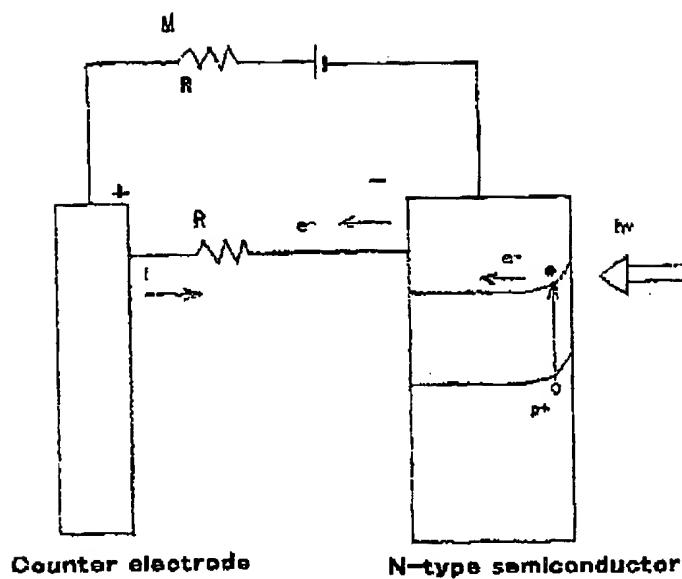
Respectfully submitted

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Encl. (2 sheets)

- 1 When the battery is connected as shown in the drawing, since a voltage is applied to the n-type semiconductor with negative pole and to the counter electrode with positive pole, an effect as the photosemiconductor is increased.
- 2 Counter electrode
- 3 N-type semiconductor



When the battery is connected as shown in the drawing, since a voltage is applied to the n-type semiconductor with negative pole and to the counter electrode with positive pole, an effect as the photosemiconductor is increased.